Recognition of contribution of a person should be one-time affair

Recognition and appreciation of merit of an individual by making an award, by decorating him with a title, electing him to a body of elites, felicitating him in a meeting or honouring him in some other way, is always welcome in the interest of the discipline in which the individual excels. It encourages and gives satisfaction to the individual, and inspires and sets an example to others. However, doing it again and again for the same person, once by one institution, then by another and so on, makes even the person lose interest in the award or recognition. It looks logical if one is honoured for one's different achievements on different occasions by different institutions. A Nobel Laureate may be honoured by top two or three institutions of the country, but if there starts a race/competition amongst different institutions for felicitating him, it more or less becomes a 'tamasha'. However, the Nobel Prize or Gandhi Peace Prize or the like may be an exception. Less significantly one is generally recognized as literateur, musician, sportsperson, social-worker, physicist, chemist, etc. for one's life-time contribution in his field. It is also true that there would be not one, but several or at least a few such persons in each field, who may deserve to be recognized. Recognition of equally meritorious or a little lesser persons is delayed or ignored, and this may hamper the progress of the discipline concerned. While giving an award in any subject, due attention has to be paid to all the broad areas, but only if and when excellence has been shown by someone in the field. The art of teaching, teaching methods and development of instrument of teaching in a subject should also be taken care of for the recognition.

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Bt-cotton in India

The article '*Bt*-cotton in India: Anatomy of a controversy' by Geeta Bharathan (*Curr. Sci.*, 2000, **79**, 1067–1075) is an overall admirable analysis of the controversy regarding the application of genetic engineering (GE) (or genetic modification using recombinant DNA technologies (GM) or transgenics as more widely used) for the improvement of crop plants. It raises many questions, a few are genuine, others reflecting some of the exaggerated concerns that have been raised earlier[1]. However, the analysis, though intellectually stimulating, is based on incorrect information and shows a lack of familiarity with the variety development and evaluation process (basic plant breeding and genetics).

Foremost, the author has mixed up two issues – Government of India not buying the *Bt*-cotton technology package from Monsanto using public money, and essentially the import of the same *Bt*-cotton by MAHYCO, a private seed company in which Monsanto later acquired 26% share. The main reason for the Government not accepting the Monsanto offer was the high cost to the public funds. Later the transgenic *Bt*-cotton seeds were imported as a commercial deal between MAHYCO and Monsanto. No public funds were involved in this transfer.

Hence, the event listed in table 1 of the above-mentioned article as 'Monsanto refused permission to backcross Bollgard into local varieties to get *Bt*-cotton' is not correct. Also the final refusal to Monsanto was in 1993 and not 1990. Thus the author's conjecture that 'One factor might be the fact that a MNC made the application in the first instance, while an Indian company did so in the second' is not correct. These incorrect inferences give wrong signals to the MNCs at a time when the country is looking for foreign investment in the agricultural sector, and other MNCs are waiting to transfer their GM varieties in India.

Similarly, in table 2 of the article, some of the features (I) and their implications (II) such as 'Not a simple case of introducing specific gene with a known effect. Sufficient period for effective screening', 'Scale of trials: 1 acre plots – 1 acre tests too small', 'Period of trials: 2 seasons, 1 to 2 seasons too short' questioning the project design are not correct. These are standard plant breeding practices. Both public sector plant breeders and private seed companies have limited resources for experimental testing of new materials.

'Farmers' lack of familiarity with pests in new cotton-growing areas', 'Inappropriate pest management', and 'ineffective transfer of technology' have no relationship to *Bt*-cotton which is yet to be approved for commercial cultivation in the country. Insect pest problem in cotton cultivation is not something new. 162 species of insects are known to be associated with cotton crop in India, of which 12 are considered as major pests[2]. It is well established that host plant resistance/tolerance helps in suppressing the pest population at low cost, and also reduces the use of chemical pesticides, thus causing less environmental perturbation. DDT, BHC, organo-phosphorus compounds, pyrethroids, besides NPV, bio-control agents, including *Bacillus thuringiensis*, pheromones, botanical pesticides like *Neem, Karanj* and garlic extracts, and integrated pest management have all been used to control cotton pests[2]. Chemical pesticides were effective initially, but later insect biotypes resistant to the pesticides have emerged. At present, *Bt*-cotton provides the best available host plant resistance and with integrated pest management can considerably reduce yield losses and pesticide use. *CryIAc* alone may not be the best strategy[3], but that is the one readily available for introduction in the Indian cotton hybrids. Other genes to develop more effective stocks are available, but to

develop transgenics and bring them to a level that they can be grown commercially, takes a long time. Local efforts currently in progress would take at least 10 years to reach the level already attained by MAHYCO. What MAHYCO has done is the best possible strategy, and the same should be followed by all developing countries, to utilize GE for the improvement of their crops. The ultimate test of the new crop varieties is the benefits realized by the farmers in terms of net returns, and their acceptance (willingness to pay for the value-added seed). From the business viewpoint, *Bt*-cotton providing insect resistance is a need-based 'product' with a large potential market. The most serious environmental risk it poses is the possibility that the *CryIAc* gene may be transferred to other cotton varieties through outcrossing[4]. The probability of its moving to wild, related species is almost nil as wild species of genus *Gossypium* are not found in the neighbourhood of cotton fields and the cytogenetic barriers[4]. Moreover, such spread of the *Bt* gene cannot cause adverse environmental effects. The other risk of the breakdown of resistance due to increase in the population of already existing resistant insect biotype or due to new mutations is a part of resistance breeding[3]. Plant breeders incorporate new *R* genes while insects and pathogens, for their own survival, evolve mechanisms to overcome the resistance[5,6].

Further, the author says '. . . Distortion of these facts by the media may have led to exaggerated response by the public'. Yet the analysis is based on at least 8 citations from popular media – *Business Line*, *Frontline*, *The Hindu* and *The Hindustan Times*.

The questions raised by the author on the scientific aspects of GE technology need no comments. The Royal Society of London, the US National Academy of Sciences, the Indian National Science Academy, the Brazilian Academy of Sciences, the Chinese Academy of Sciences and the Third World Academy of Sciences in their report[7], based on expert evaluation, and extensive discussions have recommended the use of GM technology. With respect to pest resistance the report says: 'There is clearly a benefit to farmers if transgenic plants are developed that are resistant to a specific pest'. Further it says: 'There may also be a benefit to the environment if the use of pesticides is reduced. Transgenic crops containing insect-resistance genes from *Bacillus thuringiensis* have made it possible to reduce significantly the amount of insecticide applied to cotton in the USA'.

The social issues are much more complex in India. GM crops were widely accepted in North America and the area cultivated with GM crops increased rapidly. In 1999, the area under GM crops was 28.7 (US), 4 (Canada), 6.7 (Argentina) and 0.3 million ha (China)[8]. The opposition to GM crops was initiated by the Union of Concerned Scientists in US[1], followed by Greenpeace in Europe. Gordon Convay[9], President of the Rockefeller Foundation attributes the European opposition to GM crops as 'the worry of the domination of food chain by American companies'. Others[10] attribute it to lack of economic imperatives among the farmers due to Government subsidies. In India cotton is very important for the national economy and directly or indirectly provides employment to a large number of families in handloom, powerloom, textile and garment industry[2,11]. For many *Bt*-cotton represents an imported technology controlled by a MNC, protected under the IPR, the seeds of which would be sold by a private company partly controlled by MNC; and since these are hybrids, farmers will have to buy seeds from the company every year. People fear that participation of the MNCs in the seed industry would lead to subjugation of the Indian farmer. In the changed scenario, to be globally competitive, what matters is the quality of the produce and the production cost. While intensifying cotton production, the pesticide load on the soil and environment in the growing areas should be minimized. The new textile policy[12] envisages exports to the tune of 50 billion US dollars annually by the year 2010 from 11 billion at present. *Bt*-cotton can certainly make its contribution towards reaching this target. Besides the questions raised by the author, the adverse impact on production, productivity, quality, production cost and environment by not accepting the *Bt*-cotton also need to be examined using sound scientific data.

1. Rissler, J. and Mellon, R., *Perils Amidst the Promise, Ecological Risks of Transgenic Crops in Global Market*, Union of Concerned Scientists, Washington DC, 1993, p. 92.
2. Gaur, M., *King Cotton*, Press and Publicity Syndicate of India, Jogeshwari, Mumbai, 1994, p. 258.
3. Tuli, R., Bhatia, C. R., Singh, P. K. and Chaturvedi, R., *Curr. Sci.*, 2000, **79**, 163–169.
4. Bhatia, C. R. and Mitra, R., *Proc. Indian Natl. Sci. Acad.*, 1998, **B64**, 293–318.
5. Gould, F., *Am. Sci.*, 1991, **79**, 496–507.
6. Keen, N. T., *Plant Mol. Biol.*, 1992, **19**, 109–122.
7. Report on Transgenic Plants and World Agriculture, Prepared under the auspices of several science academies, INSA, New Delhi, 2000, p. 27.
8. Akhtar, M., *TWAS Newsl.*, 2000, **12**, 4–6.
9. *Fortune*, February 2000, 164–170.
10. see Carlos, Jolly, in Bhatia, C. R., *Curr. Sci.*, 1999, **76**, 866–868.
11. Bhatia, C. R., in *Biotechnology for Asian Agriculture* (eds Getubig, I. P., Chopra, V. L. and Swaminathan, M. S.), APDC, Kuala Lampur, 1991, pp. 39–44.
12. *Textile Policy 2000*, Govt. of India, Ministry of Textiles, New Delhi.

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Response:

Bhatia states that the main difference between the Monsanto and MAHYCO projects lies in the fact that no public funds were involved in the latter; that *CryIA(c)* is currently the most appropriate gene, given the time lag in developing other genes for the purpose; that the scale of trials (area and duration) is within standard practice, given limited resources; that evolution of resistance in insects and pest management is general problem in crop improvement; that few scientific issues of concern remain regarding GE technology; and that societal issues, such as fears surrounding intellectual property rights (IPRs), cannot be given importance while entering the global market. My comments are on two scientific aspects: (i) pest resistance in *Bt* cotton, scientific issues in GE, and (ii) societal aspects (*Not* directly related